

WHAT IS CLAIMED IS:

1. A semiconductor device manufacturing method comprising the steps of:

forming a semiconductor film on a substrate;  
forming a hydrogen-containing film on said semiconductor film; and

irradiating a pulse energy beam to heat said hydrogen-containing film and thereby diffuse hydrogen in said hydrogen-containing film into said semiconductor layer.

2. The semiconductor device manufacturing method according to claim 1 wherein energy density, number of pulses and pulse width of said pulse energy beam are determined not to melt said semiconductor film.

3. The semiconductor device manufacturing method according to claim 1 wherein said pulse energy beam is a laser beam, an electron beam or an ion beam.

4. The semiconductor device manufacturing method according to claim 1 further comprising the step of irradiating other pulse energy beam to crystallize or re-crystallize said semiconductor film after the step of forming said semiconductor film on said substrate and before the step of forming said hydrogen-containing film on said semiconductor film, energy density of said pulse energy beam used for heating said hydrogen-containing film being set lower than energy density of said other pulse energy beam used to crystallize or re-

crystallize said semiconductor film.

5. The semiconductor device manufacturing method according to claim 1 wherein said substrate is a plastic substrate selected from the group consisting of polyether sulfone, polyethylene terephthalate, polymethyl methacrylate and polycarbonate.

6. The semiconductor device manufacturing method according to claim 1 wherein said semiconductor film is a polycrystalline silicon film, amorphous silicon film or single-crystal silicon film.

7. The semiconductor device manufacturing method according to claim 1 wherein said hydrogen-containing film is a silicon nitride film containing hydrogen, an amorphous silicon film containing hydrogen, or a multi-layered film of these films.

8. The semiconductor device manufacturing method according to claim 1 further comprising the step of forming a film for absorbing said pulse energy beam on said hydrogen-containing film after the step of forming said hydrogen-containing film on said semiconductor film and after the step of irradiating said pulse energy beam to heat said hydrogen-containing film, said hydrogen-containing film being heated by irradiating said pulse energy beam and thereby heating said film for absorbing said pulse energy beam.

9. The semiconductor device manufacturing method according to claim 8 wherein said film for absorbing

said pulse energy beam is a metal film selected from the group consisting of molybdenum, tantalum and tungsten.

10. The semiconductor device manufacturing method according to claim 8 wherein said film for absorbing said pulse energy beam is a semiconductor film made of silicon.

11. The semiconductor device manufacturing method according to claim 1 wherein said semiconductor device is a thin-film transistor using said semiconductor film as an active region thereof.